

Exhibit 2



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Kelly et al.

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(54) **OIL FILTER ASSEMBLY**

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This patent is subject to a terminal dis-
claimer.

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F01M 11/03 (2006.01)

(52) **U.S. Cl.**
CPC **F01M 11/03** (2013.01); **F01M 2011/033**
(2013.01)

(58) **Field of Classification Search**

CPC F01M 11/03; F01M 2011/033

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See application file for complete search history.

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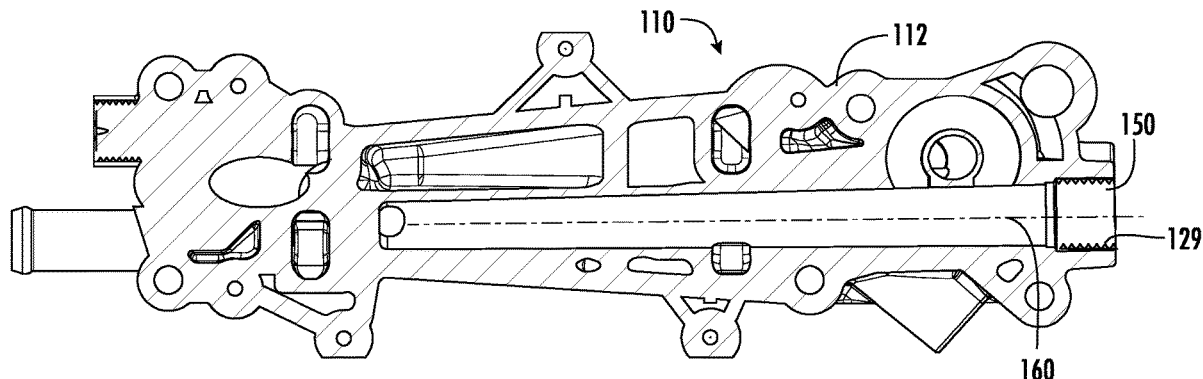
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(57) **ABSTRACT**

A one-piece cast metallic adaptor for a filtering assembly
that provides for direct threading of associated components
to the adaptor. The adaptor provides an enclosed flow path
for lubricant to flow between an engine lubrication network
and a filter housing.

6 Claims, 4 Drawing Sheets



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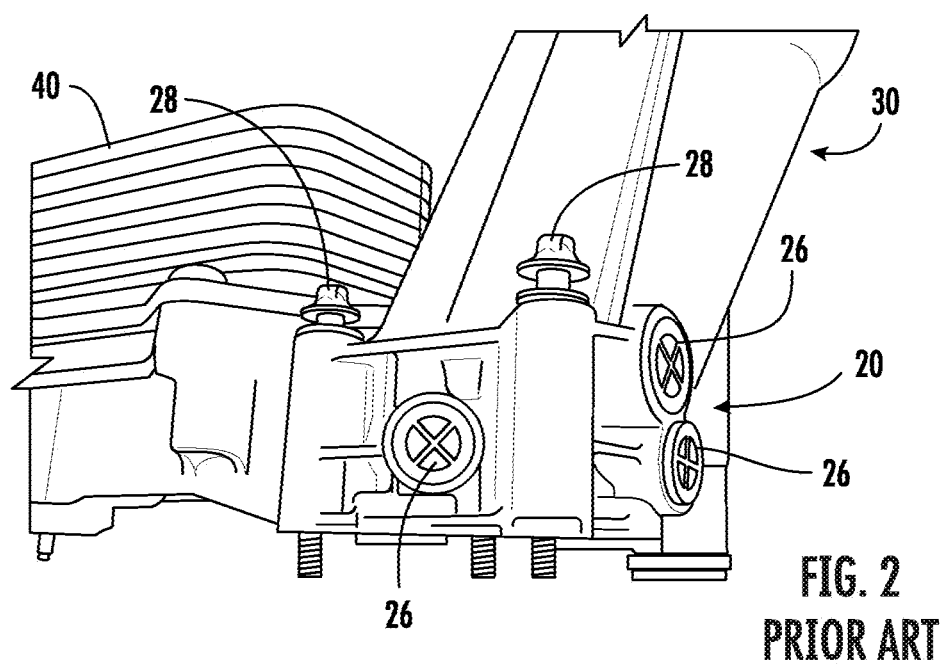
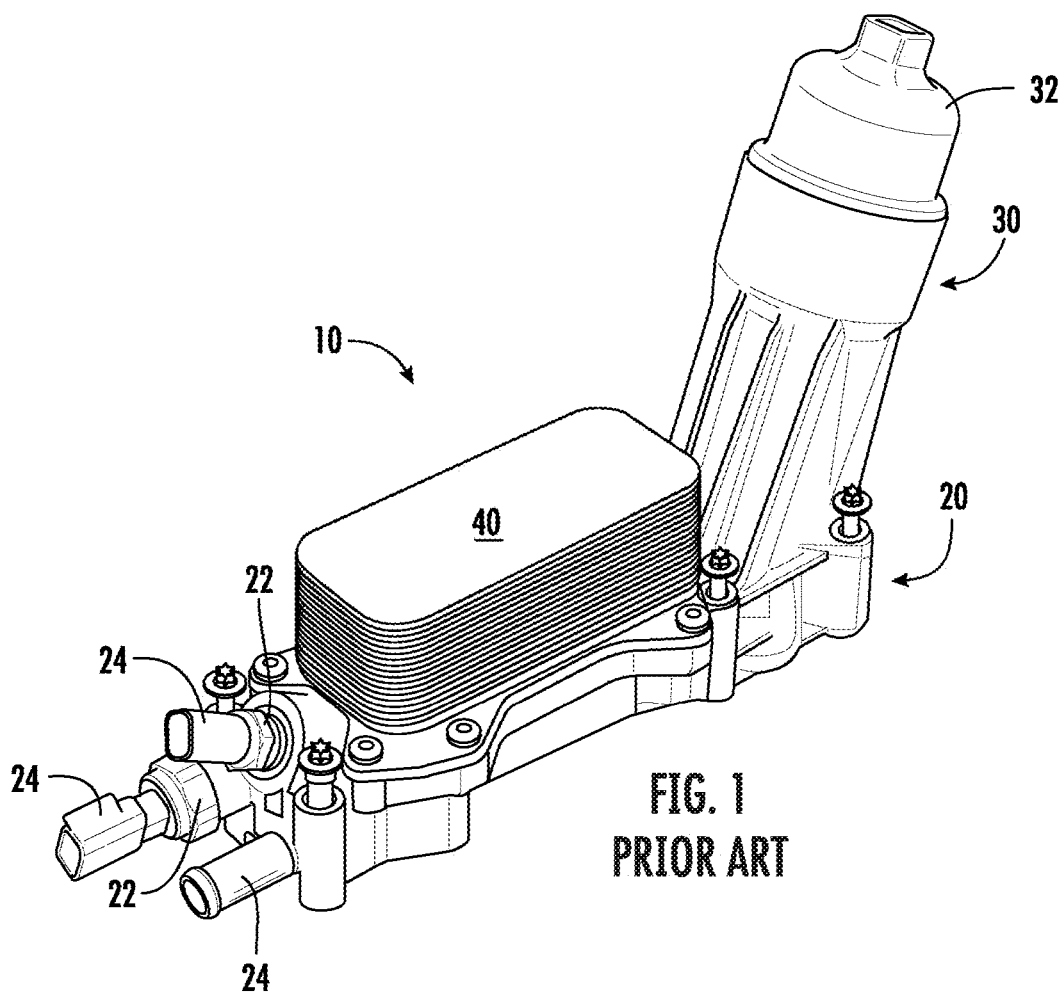
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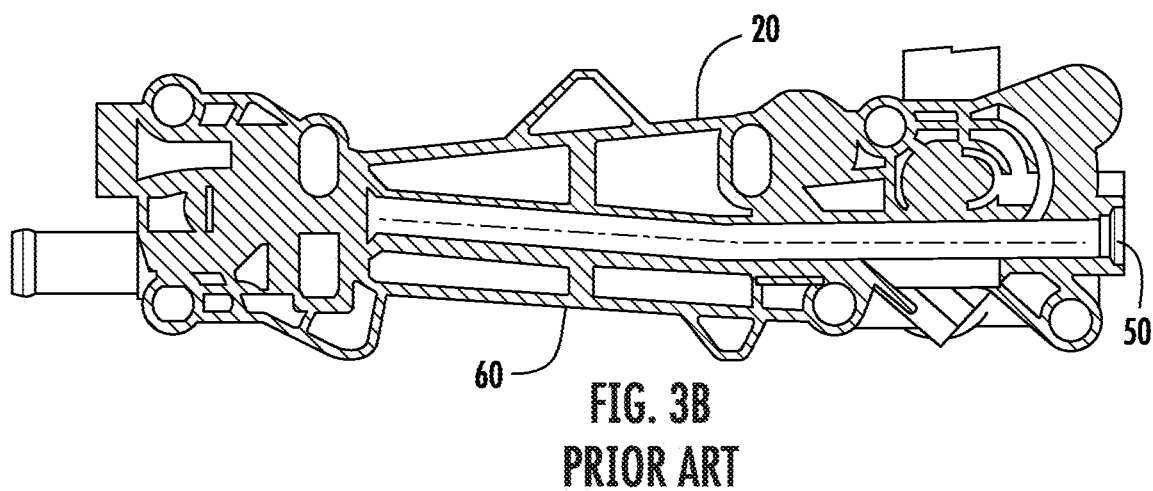
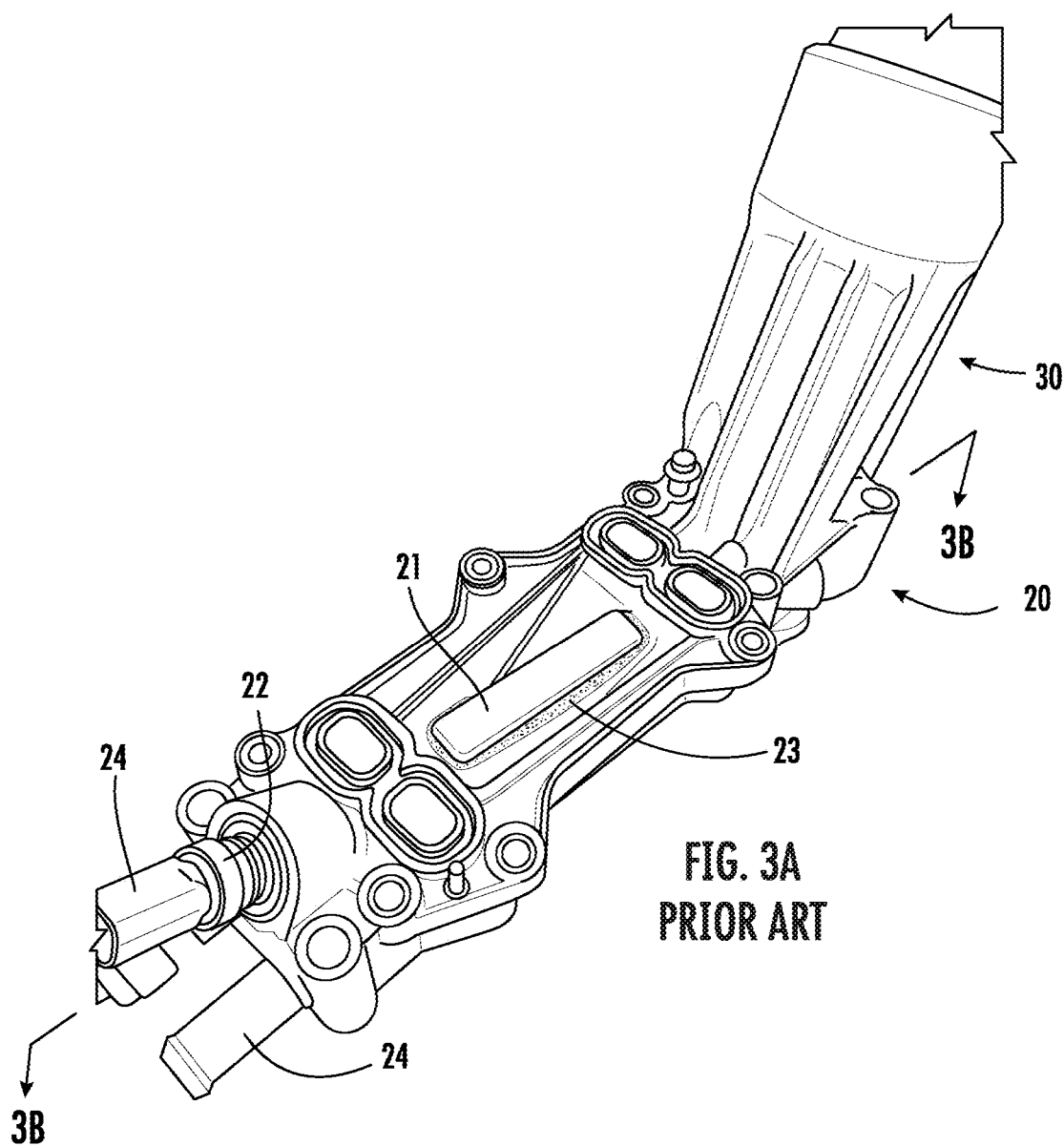
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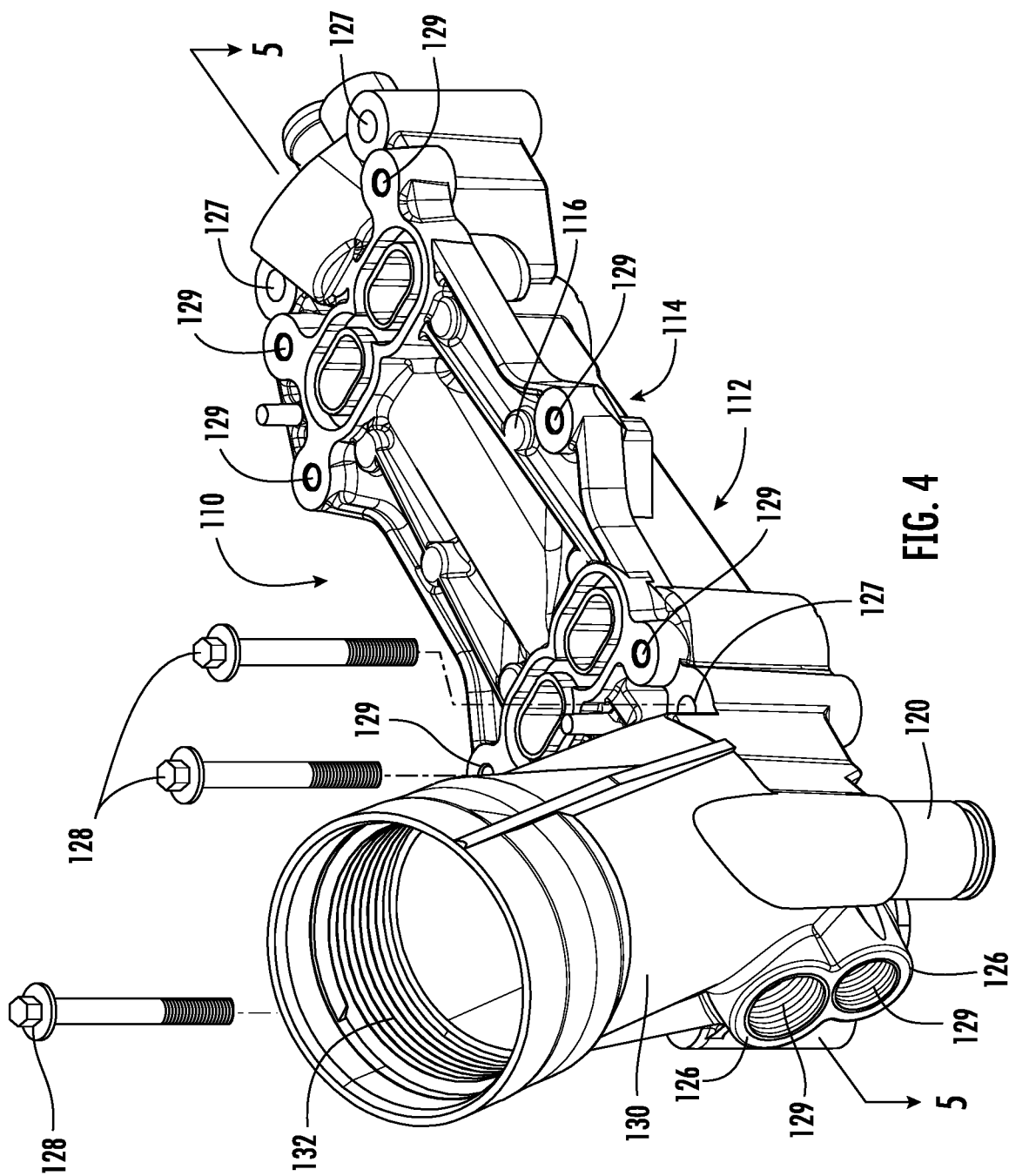
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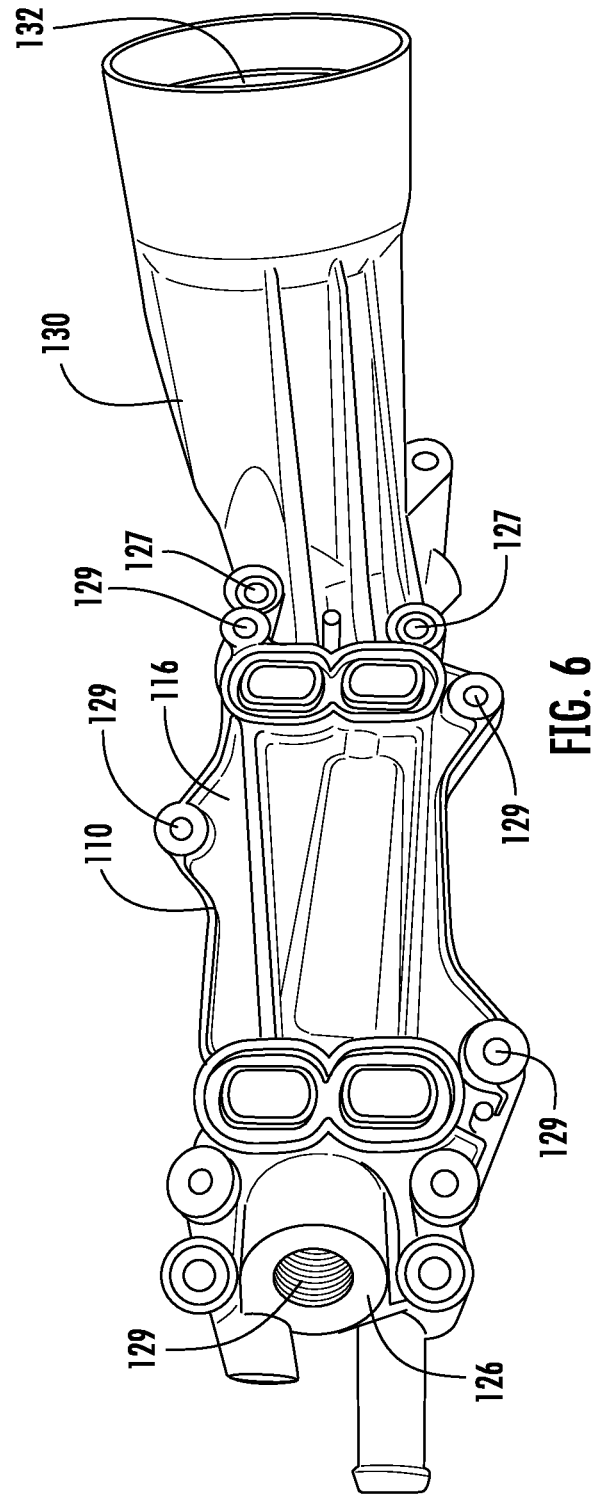
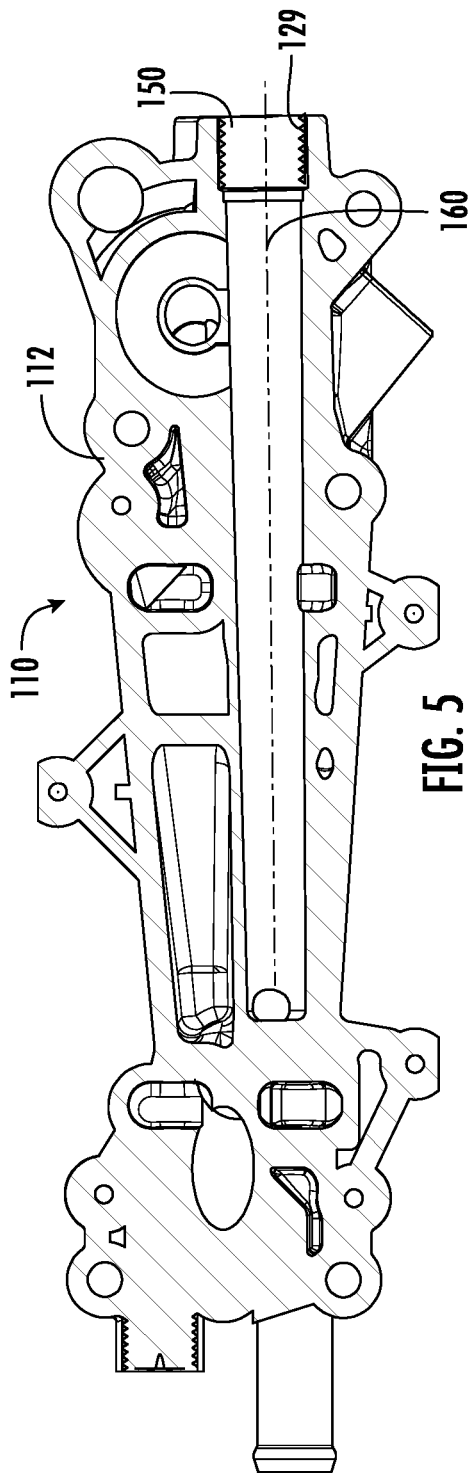
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OIL FILTER ASSEMBLY**CROSS REFERENCE TO RELATED APPLICATION**

This application is a Continuation of U.S. Non-Provisional application Ser. No. 17/406,639, filed on Aug. 19, 2021, which claims the benefit of U.S. Provisional Application No. 63/068,759, filed on Aug. 21, 2020, which are incorporated herein by reference as if fully set forth.

FIELD OF INVENTION

The invention relates generally to the lubrication of mechanical engines that utilize oil as a lubricating fluid that circulates through defined galleries in the engine. More particularly, the invention relates to a lubrication system where the lubricating fluid is routinely passed through a filter element, which is generally replaceable at certain intervals, and potentially and oil cooler. Most particularly, the invention relates to an adaptor for a lubrication system that incorporates the oil filter housing and an oil cooler in an assembly that is often located within the motor valley.

BACKGROUND

Modern engines, especially though used in motor vehicles, seek to reduce weight and size while maintaining the desired power. As part of the effort to reduce weight, many parts are being made in plastic and many parts are being combined in assemblies to further reduce weight by eliminating individual connection points. While this trend has proven successful in some areas, it has introduced problems where one or more portions of a plastic assembly experience a failure. Under these conditions, it is often necessary to disassemble unrelated parts of the engine in order to gain access to the assembly and make the necessary repairs.

Another drawback to plastic assemblies is the need to make accommodations for various sensors and system components that need to be connected to the assembly. These connections are most often achieved by molding an opening in the plastic component and attaching a metallic insert to achieve the connection. This plastic to metal connection can be difficult to properly seal. An addition failure point of this metal-plastic connector is the possibility of over tightening the inserted component, such as a sensor fitting or cap, and stressing or damaging the surrounding plastic.

In addition to the above associated with a hybrid plastic-metallic assembly, the molding process requires certain concessions in order to permit molding cores to be inserted and removed during the molding process. An associated drawback with the plastic molding is the need to remove core elements used in the process and reseal the molding which leads to further potential failure points. In addition, the unused molded openings that require closing plugs that must be glued or welded in the unused openings. These plugs represent another failure point in the plastic-metallic assembly.

SUMMARY

The applicants have discovered that a cast metallic part provides a robust assembly that avoids the needs for inserts, eliminates the need for plugs, and provides for direct threading of components to the adaptor. As a result of eliminating the assembly of multiple molded parts, the performance and

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durability is improved against burst pressure, heat and age degradation, and conditions related to cycling. In addition, the single metallic casting provides a flow path without the need for adhesives and resealing of the flow path.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a prior art oil filter adaptor and cooler assembly;

FIG. 2 is a partial rear view of the prior art assembly in FIG. 1;

FIG. 3A illustrates the capping of the oil flow path in the prior art adaptor after removal of the core used in the plastic molding;

FIG. 3B is a section illustrating the flow path in the prior art adaptor;

FIG. 4 is a perspective view of an adaptor according to the invention prior to assembly of any related components;

FIG. 5 is a section view along the line 5-5 in FIG. 4 showing the linear flow path in an adaptor according to the invention; and,

FIG. 6 is a perspective view of an adaptor according to the invention in a direction opposite to that of FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The prior art oil filter assembly shown in FIGS. 1-3B is typical of the adaptor construction resulting from using moldable plastic materials. The prior art assembly 10 in FIG. 1 has a base 20, a filter housing 30 and an oil cooler 40. The base 20 includes metal inserts 22 that are provided in the plastic construction at designated locations for the attachment of other associated components. The metal inserts and associated components are shown in FIG. 1 at 22 and 24 respectively. Although the metal inserts are frequently molded in situ during the molding of the plastic base, they remain a failure point and can result in oil leakage or worse. The metal inserts 22 are also subject to overtightening during attachment of the associated components 24, which can result in stress cracks in the plastic.

As shown in FIG. 2, the base 20, due to the molding process requiring the ability to withdrawal a core, has a number of plugs 26 that are retrofitted after the base 20 is molded. The plugs 26 are assembled to the molded base with an adhesive or spin welding. In either event, the plugs 26 are a failure point in the base 20 that can result in oil leaking or worse.

In addition to the inserts 22 and plugs 26, the base 20 has a number of metal inserts or sleeves, not shown, that are inserted to reinforce the plastic molded apertures for attachment of the various bolts 28 that hold the assembly 10 together. Here again, the inserts or sleeves introduce a potential failure point. Another potential failure point is the attachment of the cap 32 to the plastic filter housing 30. Over tightening of the cap 32 can introduce stress fracture in the threaded housing 30.

With reference to FIGS. 3A and 3B, it can be seen that the prior art flow path 50 requires a cover 21, at least partially over the flow path, that is adhered to the base after the molding core is removed by the adhesive or welding 23. With reference to FIG. 4B, it can be seen that the flow path 50 bends or is angular; in other word, the flow path 50 does not have a common longitudinal axis.

With reference to FIG. 4, the preferred adaptor 110 has an elongated body 112, which has a lower surface 114 that mates with a lubrication network and an upper surface 116

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that mates with a cooling component, a filter housing **130** and base **120** that is formed of a casted metallic material, preferably aluminum. The base **120** and the filter housing **130** are casted together and the apertures **127** for receiving the bolts **128** do not required metal inserts or sleeves to avoid stressing or cracking do to the solid metallic construction. The casting is also threaded at **129** to receive fasteners for securing an oil cooler **40** and external connectors to the adaptor **110**.

Still with reference to FIG. **4**, the casted filter housing **130** has internal threaded **132** that mate with an OEM cap **32** to secure a filter within housing **130**. In a similar manner, the apertures **126** have internal threading to preferably mate with NPT plugs that are self-sealing. Depending on the type and construction of related components, such as sensors, it may be necessary to employ a gasket or sealing rings with their assembly.

With reference to FIG. **5**, the flow path **150** for transporting the lubricant within base **120** to connect with the internal lubrication network is centered about the longitudinal axis **160** and consistent throughout the base **120**. The flow path **150** is symmetric about the axis **160** and there is no angular component in the flow path **150** as it is connected with the internal lubrication network. The flow path **150** is entirely within the unitary casting so there is no need for adding a closure to the flow path.

With the exception of the flow path **150**, the lubrication galleries and the location positions for associated components are identical to the OEM assembly so the casted metal adaptor is a direct replacement for the OEM part and no modifications or relocations of other components are necessary.

As shown in FIGS. **4** and **6**, the adaptor **110**, including the filter housing **130** and the base **120** outwardly appearance the same as the OEM part and the base accepts the OEM cooler **40** and the filter housing accepts the cap **32** without any modification.

What is claimed is:

1. An engine oil adaptor assembly for mounting in an engine valley, the adaptor comprising:

a unitary metallic casting that defines an integrated structure having:

an elongated casted body portion with a lower surface configured to mate with a predetermined existing engine;

an internal lubrication flow path formed within the elongated casted body that connects to a lubrication network within a valley in the predetermined existing engine and an oil filter housing defined at a first end of the elongated casted body; and,

an upper surface of the elongated body is configured to mate with an oil cooler;

wherein the elongated casted body includes a plurality of apertures that are directly threaded in the elongated casted body for mating with a respective threaded component.

2. The engine oil assembly of claim 1 wherein the elongated cast metallic body includes a plurality of casted apertures that are directly threaded for receiving a respective threaded fastener to secure an oil cooler with the elongated cast metallic body.

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3. An adaptor for an engine oil filtering assembly comprising:

a metallic casting having:

an elongated casted body portion with; a lower surface configured to mate with a lubrication network in an existing engine; an upper surface configured to mate with an oil cooler; an oil filter housing defined at a first end of the elongated body with an interior dimensioned to receive an oil filter; and, a wholly internal lubrication flow path that establishes a flow channel between the lubrication network and the oil filter housing;

wherein the elongated casted body includes at least one threaded passage in the casted body for mating with a respective threaded member.

4. An engine oil assembly comprising:

a one-piece metallic casting having: an elongated body portion with; a lower surface configured to mate with an existing engine lubrication network; an upper surface with an oil filter housing defined at a first end of the elongated body with an interior dimensioned to receive an oil filter; and, an oil flow path wholly within the elongated body portion that extends between the existing engine lubrication network and the filter housing;

wherein the elongated body of the one-piece metallic casting includes a plurality of threaded apertures that are threaded for mating with a respective threaded component.

5. An engine oil adaptor comprising:

an integral metallic casting that has:

an elongated body portion with a lower surface, an upper surface, first end, a second end, and an oil filter housing that is dimensioned to receive an oil filter therein;

the upper surface of the elongated body has the integrally cast oil filter housing at the first end of the elongated body and a portion of the upper surface between the oil filter housing and the second end is configured to receive an oil cooler;

the lower surface of the elongated body is configured to mate with a predetermined existing engine and has a wholly internal fluid flow path for establishing a fluid connection between the elongated body and a lubrication network within the predetermined existing engine; wherein at least one casted aperture is provided at the first end or the second end of the elongated body and casted aperture in the elongated body is threaded and dimensioned to receive an additional component is a threaded connection with the elongated body.

6. An adaptor for connecting an oil filter and an oil cooler within an engine, the adaptor comprising:

a single metallic casting having:

an elongated body with a lower surface configured to mate with an oil lubrication network within an engine, an oil filter housing at a first end of the elongated body, and an upper surface of the elongated body is configured to mate with an oil cooler;

wherein the elongated body includes: an enclosed oil lubrication flow path that is wholly within the elongated body and the extends between an oil lubrication network within an engine, and the oil filter housing; and, at least one casted aperture is threaded directly in the single metallic casting for receiving at least one additional component in a direct threaded engagement with the single metallic casting.

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